

Equality of Opportunities, Redistribution and Fiscal Policies

The Case of Liberia

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Abstract

This paper brings back the fiscal angle to the analysis of equal opportunities both by connecting traditional benefit-incidence analysis of public spending with equal opportunities and by conducting ex-ante micro-simulations on the fiscal cost of equal opportunity policies in education. Four simulations are conducted in Liberia, a country devastated by a civil war, with serious educational enrollment gaps and fiscal policies

highly dependent on international aid. Results for the simulated policy scenarios (increases in teachers' salaries, elimination of both fee and non-fee costs borne by households, and targeting public spending on education to rural schools) point to very modest redistributive effects but very different patterns of winners and losers among groups of children in Liberia.

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Equality of Opportunities, Redistribution and Fiscal Policies: The Case of Liberia

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1. Introduction

Political and economic thinking remains divided about the extent to which fiscal policies should be used to redress inequality. An early review in Barr (1987) shows how libertarians, liberals, socialists, Marxists and other collectivist views differ on the role that the state should play in reducing social and economic inequalities. Most recently, John Roemer's "Equality of Opportunities" consolidates the increasing discontent among egalitarian political philosophers on what they consider excessive attention given to the state's role to the detriment of personal responsibilities and the focus on outcomes—monetary incomes, for the most part—in the understanding of inequality. Under this view, inequality of outcomes due to differential effort is ethically acceptable, while that caused by circumstances beyond the control of individuals or that society accepts that individuals should not be responsible for is ethically unacceptable (Roemer et al. 2003: 540). It is only for the latter inequity that the state has ethical grounds to intervene and for fiscal policies to redress the situation.

Early work on equality of opportunities (Roemer 1998, Betts and Roemer 2001, Page and Roemer 2001, Roemer et al. 2003) primarily focused on this fiscal side. Those analyses invariably included a fiscal policy tool, be it educational financing (Betts and Roemer 2001), taxation and transfers (Roemer et al. 2003) or unemployment insurance (Roemer 1998), and they asked fundamentally fiscal questions. For example, in Betts and Roemer (2001), the authors examine the extent to which redirecting educational public spending would contribute to narrow

educational access across races in the US. More recent work has shifted the attention to the measurement of unequal opportunities—either constructing stochastic dominance tests or new indexes, such as the Human Opportunity Index. Also, empirical work has started to include developing countries.² Analytical changes have included the expansion of circumstances from race and parental education to additional variables to account for social background and household demographics and to include children rather than (male) adults.

The purpose of this paper is to bring back the fiscal policy angle to the measurement and analysis of equality of opportunities. In doing so, this paper conducts two separate exercises. First, it expands one of the most used distributive analyses of fiscal policies, benefit-incidence analysis (BIA), and relates it to the concept of equality of opportunities. Second, it carries out ex-ante micro-simulations of alternative fiscal policies and estimates their impacts on the distribution of educational opportunities for children in Liberia. Liberia is a case worth exploring for multiple reasons: a protracted civil war between 1989 and 2004 that devastated the country and shattered vulnerable groups, including children; a delicate fiscal position dependent on the vagaries of international aid; and only a few distributive analyses despite the existence of socioeconomic and fiscal data.

The present work differs from previous literature on equality of opportunity in that we do not control for effort (more precisely, we do not simplistically claim that effort is a residual of one or two selected circumstances), but rather focuses entirely on the role that multiple circumstances

² Cogneau and Mesplé-Somps (2009) analyze inequality of opportunities for incomes in Sub-Saharan Africa; Bourguignon, Ferreira and Melendez (2007) and Molinas et al. (2010) cover Latin American countries.

play in generating unequal access to education among children, who cannot be accountable for effort differences. Also, the analysis integrates fiscal policies as a *de facto* circumstance, that is, a decision that individuals have nothing to do with and cannot be responsible for and which most observers would agree should not matter for the legal right of children to access schools.

Results show that circumstances play a dramatic role in educational disparities among Liberian children, especially parental education, but also gender, orphanhood, birth order, location and exposure to conflict. Results indicate that that average impact on opportunities from substantial relative increases in spending may be limited. The exercise in this paper is not a behavioral simulation, however, but rather a model that sheds light on the relevance of several constraints acting against a leveled field of equal opportunities. Results strongly indicate that the average impact on opportunities from substantial relative changes in spending may be limited. This is primarily due to the meager public budget on education. At the same time, opportunity impacts are not equally distributed among types of children, implying different patterns of winners and losers caused by interventions aimed at improving equal opportunities among children.

2. The Distributive Analysis of Fiscal Policies within the Equality of Opportunity Approach

2.1. The Analysis of Equality of Opportunity

Although the empirical literature on equality of opportunities is relatively recent, it has already branched out in several directions (Appendix 1). Works can be classified into one of two

categories: (i) normative studies with a clear policy objective, using either parametric or non-parametric empirical analyses on the impact of circumstances on some specific wellbeing objective; and (ii) measuring the extent of equality of opportunities in a given country or region as part of a diagnostic approach. Also, studies differ in analyzing just one or two or multiple circumstances and opportunities.

Roemer (1998) is the seminal reference. His framework comprises five concepts (Roemer et al. 2003). *Objective* is the goal that equal opportunities are expected to achieve. *Circumstances* are the attributes of an individual's environment (either social, genetic or biological) that affect the achievement of the objective but that are beyond the control of the individual and for which society does not regard him or her responsible. *Effort* refers to individual behaviors and decisions that, together with circumstances, determine the level of objective accomplished. *Instrument* refers to the policy—typically the provision of resources—used to equalize opportunities. *Type* is a set of individuals who all have the same circumstances. Equality of opportunities prevails when an objective or outcome is achieved with the same level of effort across different circumstances. Analytically, Roemer's work seeks the value of the instrument that equalizes the value of the objective across types at any given degree of effort (Roemer et al. 2003, 542). Empirical applications of this approach are found in Betts and Roemer (2001), Roemer et al. (2003),

A second empirical approach is developed in Van der Gaer (1993), Ooghe et al. (2007), Hild and Voorhoeve (2004) and Cogneau and Mesplé-Soms (2009). It considers that there is equality of opportunities when the distribution of expected earnings is independent of social origins.

Conditional expectations of earnings (or consumption as in Cogneau and Mesplé-Somps, 2009) are obtained from the distribution of average income estimated across several categories. These categories are typically determined by parental education and/or parental occupation and, in some cases, geographical location. Some versions of this approach, as in Cogneau and Mesplé-Somps (2009) or Cogneau and Cigneux (2008), use ‘intermediary’ variables to analyze the link between social origin and income/consumption (such as social position and education). They conclude that a significant part of difference in inequality of opportunity for income/consumption can be attributed to differences in intergenerational mobility linking parental education and occupation with sons’ education and occupation.

A third analytical approach develops non-parametric statistical tests, in particular, stochastic dominance tests. Leblanc, Pistolesi and Trannoy (2008) define equality of opportunity as the situation where income distribution conditional on social origin cannot be ranked according to stochastic dominance criteria, using non-parametric statistical tests developed by Davidson and Duclos (2000) to compare generalized Lorenz curves. Again, social origin is defined by parental education and/or occupation. Leblanc, Pistolesi and Trannoy (2008) distinguish a risk component and a return component inspired in the original Oaxaca-Blinder decomposition of wage gaps in endowment and return differentials: the former assumes that within-type inequality is fully erased; the latter assumes that between-type inequality is removed. In addition, the paper develops the Gini Opportunity index, which computes the weighted sum of all the differences among areas of opportunity sets and then divided that sum by the mean income of the entire population. That makes the index independent of the wealth of a society, a convenient feature for international country comparison.

A final approach estimates the Human Opportunity Index (HOI) developed by World Bank authors Barros, Ferreira, Molinas and Saavedra (2009) and Molinas et al. (2010). The HOI has the clear analytical objective of measuring how equitably a society progresses towards universal access of basic opportunities. The index synthesizes in a single indicator how close a society is to universal coverage in a given opportunity (as with standard coverage measurements), along with how equitably coverage of that opportunity is distributed. Opportunities are goods and services that constitute investments in children, thus increasing their human capital, such as primary education and adequate housing infrastructure. An equitable policy³ ensures that a child's chance of accessing these key goods and services is not correlated with circumstances that are beyond their control, such as gender, parental background or ethnicity. The HOI 'penalizes' the extent to which different circumstance groups (*types* in Roemer's terminology) have different coverage rates: the penalty is zero if coverage rates among multiple circumstance groups are equal and is positive and increasing as differences in coverage among circumstance groups increase. The HOI is equality-sensitive and Pareto-consistent. When access to an opportunity increases equally for all circumstance groups, the index increases proportionally. Changes in the HOI over time can be decomposed into changes in the distribution of circumstances in the population (composition effect), changes in coverage rates for all groups (scale effect), and changes in the degree of inequality of opportunity (equalization effect).

³ Molinas et al. (2010) note that increasing opportunities requires not only increasing access to goods and services but, sometimes, may also come from civil rights or migration rights, for instance.

2.2. The Analytical Limitations of Equality of Opportunities

There are a number of limitations associated with the analysis of equality of opportunities. First and foremost, the conceptual distinction between circumstance and effort has not been operationalized in practice with similar clarity. Effort has either been assumed to be a residual of circumstances; to be the same within groups of individuals (typically defined by their level of earnings); or has been surpassed by restricting the focus of analysis to individuals who cannot be accountable for effort differences, that is, children. A result of this is the uncomfortable solution of luck being considered part of effort, as explicitly admitted by Roemer et al. (2003).

Interpretations are even more troublesome when, for example, gender or race become effort variables, as they are deemed residuals of socioeconomic background captured solely by parental education or occupation.

A second limitation is the arbitrary selection of some key concepts. The distinction between circumstance and opportunity is not always sharp. Family income is typically considered a circumstance, but it also constitutes an opportunity—inasmuch as it contributes to the access of basic services—for the success in life of a child. Disability is clearly considered as a circumstance for a child, but having an able, healthy status is considered to be an opportunity for future success (or current success in school). Being exposed to or the victim of insecurity may be considered equally as a circumstance (in the same way as urban or rural residence) but also as a lack of opportunity for children (when considering the potential effects on the physical and emotional development of the child).

Furthermore, what is ethically acceptable or desirable is conveniently made dependent on any society's judgment. Thus, if a society considers that females should not be educated equally as males, then gender will not be incorporated as a circumstance in the analysis. And different judgments may appear frequently across different contexts, be it for religious reasons or in contexts of conflict and historical grievances among groups. This, ultimately, creates a sort of "quicksand" baseline since few circumstances may be universally agreed upon. As a result, comparability across countries may be troublesome.

Another limitation refers to the empirical application of measurements. Equality of opportunities in a given context is sensitive to the selection of peoples and objectives, as with any other social indicator (say, access coverage). However, the HOI is also sensitive to the set of circumstances selected as well as the set of opportunities considered. Nonetheless, Narayan and Hoyos's (forthcoming) results for almost 20 Sub-Saharan African countries substantiate that results tend to be robust to changes in definitions. In a similar vein, quality issues are hardly included in the analysis, both because it is an open-ended conceptual issue (whether an opportunity is simply access to a service or, rather, access to a *quality* service) but also because datasets typically lack the information to systematically include quality considerations.

From a policy point of view, equality of opportunities does not address the causes or motivations behind the distributive features of a policy. Rather, analyses have so far concentrated on determining how the distribution of an opportunity or objective (say, income or education attainment) changes after a policy is introduced in a rather static partial equilibrium set-up. How

a policy affects intergenerational mobility within society is hardly estimated, although links between the two concepts have been explicitly pointed out (see Bourguignon, Ferreira and Menendez 2007 and references there). In addition, the depiction of policymaking so far has been very simplistic, assuming for instance that taxation is modified to simplify tax rules—that is, a flat rate is imposed to every type—or a similar increase in education spending for all children across groups. In other words, the notion of fiscally feasible—affordability—has dominated the analysis of more realistic, complex and multidimensional policies. As for the HOI, no application to policymaking has been attempted so far, with efforts mainly directed to estimating and comparing a set of comparable objectives across countries. The rest of this paper remedies this gap by developing a methodology that links HOI with public spending.

3. Fiscal Issues and Equality of Opportunities: Methodology

Methodologically, the paper carries out three separate exercises (Appendix 2). First, it estimates the HOI for access to education in Liberia for children aged 6-15. HOI is estimated in the World Bank “tradition” described above and recently applied to Latin America by Molinas et al. (2010). The set of circumstances relevant for Liberia and the selected opportunity are defined and justified in section 4, below.

Second, the paper expands the traditional benefit incidence analysis into an “Opportunity Benefit Impact Analysis” (Opp-BIA), that is, an incidence analysis of public educational spending along the distribution of opportunities, and compares it with the “traditional” BIA based on income distribution. Table 2 describes the steps for the analysis, which basically consists of conducting

the traditional BIA analysis over a distribution of children (age 6-15) educational opportunities, proxied by the expected probability of access to school conditioned on their circumstances.

The Opp-BIA has two main advantages over the traditional BIA. First, it allows focusing on the allocation of public resources in education against a concept of vulnerability *directly related* to education, and not around an indirect concept of per capita household income or consumption as done by BIA. In other words, it allows a sharper picture of the distribution of resources and opportunities directly associated to such resources. Second, it provides insights on how multiple factors (all those considered relevant circumstances) affect the distribution of educational resources. This is not to say that the analysis determines *causality* between circumstances and educational benefits (in the same way that a traditional BIA does not establish causality between household incomes and education spending), but it certainly complements the insights provided by the traditional BIA based on household per capita income.

Third, the paper conducts an ex-ante simulation analysis of fiscal implications of redistributive interventions aimed at improving the HOI profile in Liberia. In particular, the exercise simulates the distributional consequences of re-assigning public expenditures across different circumstance groups. Also, it examines the consequences of budgetary increases to improve opportunities for all, regardless of circumstance. Critical for this exercise is the inclusion of public spending on education as an *ad hoc* circumstance for children. Thus fiscal policy acts as both an instrument for improving equality of opportunities as well as an exogenous circumstance to households. This is compatible with the HOI. Molinas et al. (2010) acknowledge that, in specific contexts,

policies and circumstances may become the same; even modifying the distribution of circumstances can itself become a policy.

The steps involved in this simulation exercise for Liberia are as follows:

Step 1: Computing Opportunities with Spending as Circumstance. Estimate a *logit* model whose dependent variable is a dummy taking the value 1 if the child age 6-15 attends public school; independent variables include potentially relevant circumstances (for which information is available): child's gender; household head's gender, education and age; region of the household; urban or rural nature of the community where the household is located; number of elderly in the household; single parent, mother alive and father alive. In addition to these circumstances, gross unitary public spending on education, "S" is also included in the logit specification. Gross unitary public spending refers to the average benefit that a child receives from the government because he or she attends school. This benefit may be in the form of cash transfers, school vouchers, free materials or meals and the implicit cost per student of public education provision. In the case of Liberia, this benefit includes only the implicit average cost of education, as no other programs are currently available.

$$\ln \left[\frac{P(T_i = 1)}{1 - P(T_i = 1)} \right] = \alpha + \sum_{ij} (\beta_j X_j)_i + \delta S_i + u_i$$

where $T_i=1$ indicates whether or not the group "i" of children attends school or not and X_j are the j-circumstances believed to affect school attendance.

A new distribution of probabilities of attending school is estimated across children with different sets of circumstances and public spending benefits:

$$P(\hat{T}_i = 1)$$

Appendix 3 below reports the results of the estimated *logit*.

Step 2: Policy Shock. Once the parameters of each circumstance determining the opportunity of attending school are estimated, changes or “shocks” to the distribution of public spending on education are introduced: S^{sim} . These changes consist of increasing or decreasing the gross unitary public transfer implicit in public education provision and/or changes in the distribution of benefits based on different qualifying conditions, such as age, gender or location. The critical—and strong—assumption is that increasing public spending will not lead to increases in the private contribution necessary to attend public schools—neither for those children already enrolled nor for new children not previously attending school who will now attend as a result of the new policy—at least in the short run. A second critical assumption is that there are no economy-wide or inter-sectoral effects. Increasing spending on education may, for example, mean building more schools in rural areas, and hence the parameter associated with location may change as a result. Such interactions are ruled out in the exercise, which merely implies a monetized transfer to beneficiaries. Four policy shocks are considered in this paper: from a purely ‘redistributive’ scenario in which public resources are taken away from certain groups and transferred to other more vulnerable

groups (at an assumed zero cost) to scenarios involving a net fiscal cost from removing *de facto* school fees, reducing non-fee costs or increasing teacher salaries.

$$P(T_i = 1)^{sim} = \hat{\alpha} + \sum_{ij} (\hat{\beta}_j X_j)_i + \hat{\delta} S_i^{sim}$$

The resulting new estimated probabilities from this step are:

$$P(T_i = 1)^{sim}$$

Step 3: Attribution. The difference in the estimated HOIs in step 2 and in step 1 is the impact attributed to the policy shock. The critical assumption in this case is that no household behavioral changes result from the policy change. In other words, the simulation is a pure demand shock that allows no behavioral change. This follows the tradition of static BIA analysis as described in van de Walle and Knead (1995).

$$P(T_i = 1)^{sim} - P(T_i = 1)$$

A few considerations are in order. Endogeneity between public spending and education enrolment rates is a potential issue. While this is certainly possible (and even desirable from a policy point of view) at a macro or aggregate level, it is not obvious from a household's perspective. Endogeneity at this level would imply that public policy decisions would be affected by a specific household's condition. This is at best hard to defend.

A second consideration is the double nature of public spending as a policy tool and as a circumstance. There are three arguments supporting this decision. First, as indicated above, public spending levels and its composition are exogenous to a particular household condition. Households are assumed not to vote with their feet, so to speak, choosing different levels of spending across regions. This would not be a realistic proposition in Liberia, at least not on education considerations. Second, one would argue that the level and composition of spending that an administration decides should not compromise the right of Liberian children to receive education. Third, this case is no different from other less clear-cut candidates for circumstance, as shown in section 2, where the distinction between circumstance and opportunity is not so clear (say, household level of income or consumption).

4. Data

4.1. Educational Opportunities in Liberia

The education system in Liberia is composed of primary, secondary, and tertiary levels. Pre-primary education covers three years, followed by six years of primary education (grades 1 to 6). Secondary education consists of three years of junior secondary high school, followed by three years of senior secondary high school. Numerous private sector, community-based, faith-based, and concession-sponsored organizations provide education and training services alongside government educational institutions (World Bank 2008).

Since 2005/06 spending on education has increased in Liberia, a result of the government's raising public spending and increases in education financing by international donors, rather than an increasing prioritization in the sector (World Bank 2010). At 2.9% of GDP in 2007/8, public spending on education in Liberia is lower than in other conflict countries in the region and well below the share of public spending in Sub-Saharan Africa (13% vs. 20% of public spending, respectively). The contribution of households to finance education is very substantive. World Bank (2010) reports that in 2007/8 total resources in the public education system of US\$ 77.2 million, accruing from the government --US\$12.2 million— were only half those provided by households -- US\$27 million — (and the US\$38 million by international donors).

In 2002, the Education Law made primary education free and compulsory, although user fees are still reported at a large scale. Enrolment in primary and secondary levels have increased since the end of war, but the country is still far from universal primary education and there are clear gender, regional and income disparities in access to education (World Bank 2008).

In this context, two issues are relevant when selecting indicators for education that can be considered “opportunities”. First, indicators must be available from existing data sources and can be consistently collected over time in order to conduct inter-temporal comparisons. There are two potential data sources, the Demographic and Health Survey (DHS) for 1986 and 2007 and the Core Welfare Indicators Questionnaire (CWIQ) for 2007 and 2010. Given that the DHS of 1986 differs significantly from later DHS surveys and that CWIQ provides more recent information, the HOI analysis for Liberia is conducted using CWIQ. Also CWIQ data matches

the school attendance computed by the Liberian Census 2008 better than DHS data. The CWIQ (2007) draws from a sample of 3,600 randomly selected households located in 300 randomly selected clusters. Table 1 below presents preliminary results of the incidence/coverage rate of opportunities in Liberia for 2007 and 2010.

[Table 1 about here]

The second relevant consideration in the selection of opportunities refers to coverage. Table 1 shows that a number of indicators previously used in Latin American analyses may not be useful in the Liberian context, as late entry into school appears to be common due to the lingering effects of conflict. Late entry and frequent interruptions also affect timely completion of 6th grade, thus questioning the relevance of timely entrance and/or graduation as an indicator to analyze equality of opportunities. In lieu of that, the proposed indicator for the HOI analysis of educational opportunities is the *proportion children of age 6-15 who attend school*.

4.2. Relevant Circumstances in Liberia

Even when a list of universally accepted circumstances is elusive, circumstances such as gender, parents' education, incomes and location are widely considered conditions that should not affect access to key public services. Historical conditions in Liberia justify analyzing inequality along other dimensions as well. Ethnicity (or a proxy for that) can be a relevant circumstance in this multi-ethnic country. Given the recent devastating conflict, whether a child has a missing parent

and whether s/he belongs to a household that was displaced by the conflict may turn out a relevant circumstance as well. With these considerations in mind, the following list of circumstances are used for HOI analysis: (1) urban or rural residence; (2) region (six in number); and (3) economic status (proxied by asset index) of the household; (4) gender of the child; (5) gender and age of household head; (6) education of household head (number of schooling years); (7) parental presence in the household; (8) number of children in the household, and presence of elderly; (9) exposure to the conflict.⁴ Table 2 below reports the basic descriptive statistics for these circumstances.

All these circumstances are available from both CWIQ of 2007 and 2010, except for urban/rural and regions, which are not reported in the CWIQ 2010. Since direct information on ethnicity is not available from CWIQ 2007, region may be considered a reasonable proxy for ethnic differences.⁵ The circumstances associated with the impacts of conflict are quite prevalent: around 30 percent of children do not have both parents and 82 percent are from households that were displaced by war in the 1990s. Several possible circumstances relating parental presence in the household can be analyzed. One possibility is that both parents are alive and living in the household; others include one parent absent from the household, either alive or dead, or both parent absent from the household, either alive or dead. As the effect on opportunities of parental absence may differ from, say, a living father sending remittances home vis-à-vis a dead mother, the most encompassing option is to analyze several circumstances and determine ex-post which

⁴ Similarly, a child's birth order may affect decisions on his or her education, as it is shown to do in terms of consumption decisions, school attendance and distribution of chores at home, for instance. However, no CWIQ reports this information. We use age as a proxy for birth order. Age is also a relevant circumstance, given that late entry in school is a common phenomenon in Liberia.

⁵ Liberia has several ethnic groups. The population is divided in Kpelle 20 percent, Bassa 14 percent, Gio 8 percent, Kru 6 percent and 52 percent spread over 12 other ethnic groups. Kpelle in central and western Liberia is the largest ethnic group. Grebo and Kru are concentrated in the southern area, Bassa in the Grand Bassa area, and smaller groups such as Loma and Gbandi in Lofa. <http://www.globalsecurity.org/military/world/liberia/maps.htm>.

is the most determining and influential one. Interestingly, some 74 percent of households with single parents are led by women. Only 10 percent of single-parent households have a child with a father not alive. That would point to single motherhood rather than orphanhood as the primary cause for parental absence.

Selected circumstances (as well as opportunities) must be congruently defined over time, that is, for the CWIQ 2007 and 2010. As the computation of HOI requires estimating a logistic model as a function of circumstances, changes in the definitions of circumstances or in the list of circumstances used over time may affect HOI measurement. The variables reported in Table 2 are confirmed to have comparable questions in both rounds.

[Table 2 about here]

5. Results

5.1 HOI School Attendance in Liberia

The estimation of the 2007 HOI for school attendance among children 6-15 is 59.5 percent, four percentage points below the observed coverage rate of 63.5 percent, a difference that is statistically significant -- as shown in Figure 1. These two values remained largely unchanged for both the HOI and observed coverage rate in 2010 (60.3 percent and 65.3 percent, respectively).⁶ In both cases, the difference between HOI and observed school attendance is statistically significant. The penalty (share of access to opportunities allocated in violation of the equality of

⁶ It is worth noting that decomposition between both years is conducted for an unweighted sample with no information on location of the household, given that at the time this paper was completed the information on weights and location of households was not available for CWIQ 2010. Subsequent analyses for CWIQ 2007 use population weights. A robustness check of the effect of weights on results shows that the level of the HOI seems to increase without weights, but that does not affect main conclusions.

opportunity principle, see Molinas et al. 2010) is about 4.0 percentage points in 2007 and 4.9 percentage points in 2010, indicating that over time educational opportunities measured through school attendance of children age 6-15 have not become more equally allocated.⁷

[Figure 1 about here]

Regarding the estimated probabilities of attending school across types of children, for simplicity only eight types of children are reported here based on three circumstances: household head's education, child's gender and location of the household in 2007. The remaining circumstances are considered in the simulations but are not used to discriminate among groups when reporting average results by type. The first four types are opportunity-vulnerable—their estimated probability of attending school given their circumstances is below the observed average access rate, 63 percent (Table 3). In contrast, the last four types are non-vulnerable as their probabilities are above the observed average access rate. The education of the household head seems to be the most critical factor in the estimated distribution of opportunities: all vulnerable types have parents who have not completed primary education. For the rest of circumstances, vulnerable as well as non-vulnerable types include children both in urban and rural households, and both female and male children.

⁷ Although not reported here, household head characteristics and wealth are the most important factors explaining the unequal distribution of this opportunity. In 2010, results point to a similar pattern, though the importance of child characteristics increases. A decomposition of the estimated change in HOI between 2007 and 2010 indicates that most of the HOI's small increase over time is due to a scale effect (increased access for all, without regard to equity), accounting for 1.99 percentage points, while equalization effects (greater equity in access) between both years account for -1.29 percentage points and composition effects (change in the composition of circumstances) account for the remaining 0.1 percentage point. This means that the observed improvement is mostly due to changes in the coverage rate and not to egalitarian improvements in the distribution of attendance or in the distribution of circumstances across the population.

[Table 3 about here]

5.2 Opportunity-Benefit Incidence Analysis (Opp-BIA)

Three patterns of education spending—the distribution of monetized benefits accruing to children attending public schools in Liberia per beneficiary (“gross unitary public transfer”), the distribution of private out-of-pocket household spending incurred as a result of attending schools per beneficiary (“unitary private spending”), and the resulting difference between public benefit and private contribution towards school attendance, “net unitary benefit”, again on a beneficiary basis—are now compared (Figure 2). World Bank (2010) reports total resources in the public education system of US\$ 77.2 million, accruing from three sources: US\$12.2 million by the government, US\$27 million by households and US\$38 million by international donors. Gross unitary public transfers are obtained by dividing government’s and donors’ educational spending by level of education among enrolled students: US\$ 6.9 per student enrolled in primary education and US\$ 84.5 per student enrolled in secondary education. Unitary private spending is obtained directly from household’s reports on their actual spending on children attending school. These patterns of average public resources spent per student and households’ average private contributions towards education are compared against the distribution of household wealth⁸ and the distribution of educational opportunities, proxied by the estimated probability of attending school conditional on their circumstances (see Table 1 above). The former generates traditional BIA, while the latter an “Opportunity BIA”.

⁸ There is no direct interpretation of the values of the wealth index. The wealth index is constructed with principal factor analysis (PCA) of information on assets in the household. The source data are a series of dummies where 1 is assigned if the household has the asset (television, car, radio, etc). We construct z-scores of the data and project them onto a new basis using the eigenvectors that decompose the covariance of the data. Intuitively, we are using the information of asset ownership to rank households according to their ownership of goods, giving more weight to the information that explains the largest part of the variance in the asset dummies.

Results from both BIA exercises are staggering. Liberian households make private contributions towards public education that generally exceed the public transfers implicit in the provision of public education (Figure 2a). This is in line with the aggregate contributions towards all educational spending reported for that year by World Bank (2010), which at US\$ 27 million more than double the government's US\$12.2 million financing. From a distributive point of view, unitary private spending towards public education increases by levels of wealth while unitary public transfers hardly change among wealth quintiles. This results in a distribution of *net* public benefits that is increasingly negative, showing a progressive distribution for the 'wrong reasons': progressivity is achieved because of increasing private contributions from households as their wealth increases, rather than by increasing public transfers to poorer households.

This picture is even more dramatic when considering the distribution of educational opportunities (Figure 2b). Once quintiles are computed from the distribution of attending school probabilities among children age 6-15, it becomes clear that children in the bottom two opportunity quintiles (with an expected probability of attending lower than 52 percent) rarely attend school. This leads to a very small average group gross unitary public spending and unitary private spending in these two quintiles. Children in the third quintile, with an estimated probability of attending school given their circumstances of 52-71 percent, appear to contribute slightly more than the previous groups. Households from the top two quintiles of the distribution of attending probabilities (71-85 percent and 85-100 percent, respectively) clearly contribute privately towards school attendance, more so in the case of the top quintile.

As a result, the Opp-BIA shows the same peculiar progressivity caused by an increasing private contribution among non-vulnerable households and a very low and uniform public transfer. However, the Opp-BIA shows an even more unequal distribution than traditional BIA. It shows, in fact, that only those most able to pay for public education are likely to attend a public school. Those with a set of circumstances that make them vulnerable are not participating much in the distribution of meager public transfers. By including all children age 6-15 in the distribution of benefits, either attending or not, the Opp-BIA provides a more comprehensive picture than traditional BIA, which only depicts the benefits to those who actually attend school. In doing so, the Opp-BIA analysis presents a bleaker picture of educational spending incidence in Liberia than traditional BIA.

[Figures 2a and 2b about here]

The BIA also provides evidence of the shares of benefits captured by socioeconomic groups. The traditional analysis of shares (Figure 3a) indicates that the pattern of public spending on education in Liberia is clearly not pro-poor. In fact, it follows a very neutral distribution, almost proportional to the share of beneficiaries by quintile (the only exception being a more than proportional concentration of benefits in the third quintile of the distribution of wealth). Incidence analysis based on opportunities (Figure 3b) shows, once again, a bleaker scenario, in which the share of benefits is below the population share for three out of four vulnerable groups of children (groups 1, 2 and 4). The opposite occurs for three out of four non-vulnerable groups of children, 5, 6 and 8, whose share of benefits exceeds their share of children age 6-15. The Opp-BIA confirms that the distribution of benefits is less pro-poor when analyzed against

opportunities than wealth levels: children age 6-15 belonging to vulnerable categories represent 45 percent of the total population of children of that age and receive only 37 percent of public benefits.

[Figures 3a and 3b about here]

5.3 Redistributive Simulations

Table 4 presents the results of the four simulated scenarios. Simulation 1 has an *increase in total government transfers by an additional 70 percent equally distributed to all children eligible to attending public school*. This additional amount is the share of the budget that would be required to equalize the current salaries of teachers to regional standards advocated in the Fast Track Initiative, Education for All (see World Bank 2010). The simulation increases by 70 percent the current public transfer to each child eligible to attend public school.

Simulation 2 represents an *increase in transfers for all children eligible to attend public schools in the form of fee expenses recovery*. In policy terms, the intervention conceived in this scenario is a voucher for each child eligible to attend a public school equivalent to the average monetary cost of households' contributions in the form of implicit fees to the public school (current fees are informal or implicit since they are officially eliminated). This does not necessarily imply that each specific household would be exactly compensated by the amount of fees paid as reported in the CWIQ but by the *average* fees paid by children attending public school at age 6-15.

Simulation 3 is an *increase in transfers for all kids eligible to attend public school to compensate for the current non-fee expenses* (such as books and uniforms). This corresponds to giving each child in public school a subsidy equivalent to the average monetary cost of non-fee expenses in public and private schools.⁹

Simulation 4 is a *pure redistributive scenario, in which all public resources channeled into beneficiaries of urban public schools are redistributed to children attending rural public schools on a per capita basis*.¹⁰ This is not to say that this is a realistic or desirable policy; rather, the scenario provides a sense of the redistributive potential that such a ‘draconian’ intervention would have.

[Table 4 about here]

Results in Table 4 report the *average* probability to attend public school for each group before and after the shock, and the respective changes on HOI attributed to the shock.¹¹ Also, it provides an indication of the additional per beneficiary fiscal cost associated with each scenario. A first finding is that the overall impact in all four simulations is quite limited in magnitude, even when they involve large swings in resources (simulation 4) or large relative increases in transfers (simulations 1 to 3). This implies that even when changes are substantial in relative

⁹ We could have also used the average spending in non-fee expenses only in public school. This would have biased downwards the cost of diminishing inequality, since children in public school are likely to spend less than the presumably more appropriate amount spent in better-equipped private schools.

¹⁰ Note that we base our exercise on estimates for children in public schools, since it is assumed that the government will not assign policies that affect the children already in the private system that might be paying fees to private entities. This assumption limits the extent of the policy effect, but seems more reasonable in terms of policy implementation.

¹¹ Following the recent literature on the HOI, we used the geometric mean version of the index for the simulations in Table 4. The geometric HOI respects the property of sub-group consistence and is not weakly sensitive to inequality as in the linear version of the index.

terms, they are very small in absolute terms: none produces budgetary increases in excess of US\$10 million. As a result, no substantive improvement in opportunities in Liberia will occur with levels of educational spending as low as these observed.

A second key result is that the single largest increase in HOI comes from simulation 3, that is, from reducing non-fee expenses from households. This would eliminate the source of monetary contributions for households. This comes at the largest costs as well for the government, at about 92 percent of the current public budget on education. Since the average cost of non-fee expenses is calculated using an estimate of the household average spending in non-fee school items the population, we are effectively bringing the spending of children in public schools closer to the spending of children in private schools regarding textbooks, uniforms and other school materials. Interestingly, the purely redistributive simulation, simulation 4, causes an overall deterioration in the HOI, as the reduction in urban household HOI is not fully compensated by the increased HOI for rural households (given that many current eligible but non-participating children in rural areas will improve their situation as a result of the simulated intervention).

Behind the modest estimated average effects on the distribution of opportunities, there are different patterns of winners and losers for each scenario. However, these patterns do not seem to cause large compositional effects among the different types of children. In fact, none of the groups change their vulnerability status as a consequence of the policy intervention. Interestingly, rural groups tend to do better than urban children in all four simulations. In the first three simulations, all groups benefit in net terms, but some benefit more than others. The

smallest win in simulation 1 is found among urban female children with non-educated heads. In simulation 2, the smallest win is found among urban female children with educated heads. In simulation 3, urban male children with educated heads win the least. The groups with the largest wins are rural male children, both with educated and uneducated heads. Only simulation 4 has net winners and net losers: rural male children with non-educated and educated household heads and urban male children with non-educated heads, respectively.

6. Conclusions

This paper adds to the existing work on equality of opportunities and fiscal policies, linking the recently developed HOI to fiscal issues. It does so by including the equality of opportunity angle to traditional BIA and by simulating the equity impacts of redistributive interventions on opportunities, rather than on traditional welfare outcomes. The empirical analysis is conducted for Liberia, a case in which both short-term development and longer-term opportunities improvements after a long civil war are paramount policy objectives.

The probability of attending public school in Liberia has improved over time. Household head's education appears to be very influential in the distribution of children's educational opportunities. Incidence results indicate that a traditional BIA may not fully pick up the staggering incidence of public resources in education. The opportunity BIA substantiates that children whose circumstances make them vulnerable are very unlikely to attend school and, as such, benefit from any implicit transfer of resources from public education. The main reason

appears to be the high private contributions (vis-à-vis public transfers) necessary to attend a public school in Liberia.

Simulation results show that draconian redistributive interventions—without sector changes or changes in circumstances—may lead only modest improvements in the probability of attending school (less than three percentage points) and have little effect on the *average* vulnerability status of children. Results also show that some types of children defined by their circumstances would not slip into opportunity vulnerability, while other types are not likely to move out of vulnerability following the simulated redistributive interventions. Notwithstanding these results, rural children tend to benefit more than urban from all simulations.

Simulation results need be taken cautiously. The analysis is not intended to provide detailed normative conclusions. Yet, it highlights the fact that some interventions may have a different pattern of winners and losers. These patterns change by intervention, and the costs associated to them also vary substantially. The critical take-away message, however, is that at the level of public spending on education (US\$12.2 million), little can be done to improve substantially opportunities among children. In addition, the analysis shows that in spite of large increases in spending a number of circumstances act as serious constraints in determining the probability of enjoying an opportunity. In this respect, by focusing ex-ante on opportunities rather than outcomes, the analysis underscores that the traditional short-term analysis of welfare outputs may be complemented with a longer-term discussion addressing how to remove critical obstacles to an egalitarian allocation of key public services.

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Appendix 1: The Analytics of Equality of Opportunities

Approach, Study	Analytical Objective	Analytical procedure	Definition of Circumstance	Definition of Opportunity	Key Findings
Normative					
Betts and Roemer (2001)	Analyze fiscal allocations that equalize opportunities in US.	$\underset{x^1, x^2, \dots, x^T}{Max} \underset{t}{Min} v^t(\pi, x^t)$ <p>subject to $(x^1, \dots, x^T) \in X$</p> <p>Where $v(\pi, x)$ is the value of the objective of individuals in type t at quintile π of the effort distribution in type t, if the type is allocated x in resources by the policy instrument, with X defined as the feasible set of policies. The solution is the policy that maximizes the minimum value of the objective for all agents of all types at effort quintile π.</p>	Race and parental education (among males)	Wage incomes	<p>Equalizing opportunities across races in the US at a given educational budget would entail spending nine to 18 times as much on blacks as on whites.</p> <p>Color-blind policies that equalize opportunities based on parental education alone do almost nothing to change the distribution of blacks across earnings quintiles.</p>
Roemer et al. (2003)	Determine the extent to which tax and transfer regimes equalize opportunities in 11 OECD countries.		Parental education and native ability (IQ test of parents during youth in US, Denmark, Sweden and the Netherlands)	Gross pre fiscal and net disposable household incomes	<p>Northern Europe income taxation regimes are optimal in terms of equal opportunities and some even tax more than equality of opportunity requires.</p> <p>When individual ability is considered, Sweden and Denmark still over tax.</p>
Measurement					
Leblanc et al. (2008)	Compare the stochastic dominance of different income distributions conditional on different sets of circumstances across countries.	<p>Determine the stochastic dominance of a distribution of incomes x conditional on circumstance set s and the distribution of incomes conditional to another set s':</p> $\forall x \in \mathbb{R}_+ \quad s \succ_{SSD} s' \Leftrightarrow \forall p \in [0, 1] \quad GL_{F(\{s\})}(p) \geq GL_{F(\{s'\})}(p)$ <p>Where $GL_F(p)$ is the value of the generalized Lorenz curve at p for the distribution $F(\cdot p)$ and SSD a second-order dominance test.</p> <p>Also, the authors define the Gini Opportunity Index,</p> $GO(x) = \frac{1}{\mu} \sum_{i=1}^k \sum_{j>i} p_i p_j (\mu_j (1 - G_j) - \mu_i (1 - G_i)),$ <p>Where μ denotes the mean of the income distribution, G the Gini coefficient, p the population share, and i the set of</p>	Parental education and occupation	Gross pre fiscal annual household income and net disposable annual household income	<p>Among nine OECD countries, the hypothesis of equal opportunities of household incomes cannot be rejected only in Sweden.</p> <p>A correlation between GO and G of 0.67. Yet at a similar G of incomes between France and Netherlands, Netherlands is much more opportunity-equal than France.</p>

		circumstances.			
Cogneau and Mesplé-Somps (2009)	Compute and compare an index of inequality of opportunities for income across five Sub-Saharan African countries.	<p>Compute a new opportunity inequality index</p> $VdG_c = I[E_c(Y o), p_c(o)]$ <p>where:</p> $E_c(Y o) = \sum_s E_c(Y o,s) p_c(s o)$ <p>C indicates the country of analysis, o accounts for social origin, s is the intermediary outcome (son's social position), p(s/o) is the conditional probability of reaching the social position s given the social origin o, and E() the income expectation conditional of income.</p>	Social origins by parental education and occupation	Household per capita consumption	Ghana has the lowest income inequality among individuals of different social origins, while Madagascar the highest. Ivory Coast, Guinea and Uganda fall in between but cannot be ranked unambiguously.
Molinas et al. (2010)	Assess the status and evolution of equality of opportunities in Latin America.	<p>Compute the HOI defined as:</p> $HOI = C - P$ <p>Where C is the observed coverage for the opportunity and P is the penalty of inequality of opportunity, computed as:</p> $P = \sum_{k=1}^v (M_k - \bar{M}_k)$ <p>Where N is total population, M_k is the number of people with access to a good or service within vulnerable circumstance group k, and \bar{M}_k is the number of people in that group needed to equal the average rate.</p>	Typically: parents' education, family per capita income, number of siblings, presence of both parents, gender of the child, gender of the household head, and urban/rural location	Education dimension: completion of sixth grade at proper age (13); school attendance of children 10-14. Housing dimension: access to safe water and adequate sanitation; access to electricity	<p>Aggregated HOI for Latin American countries as a whole has increased during the last 15 years but there are many disparities among countries and across opportunities.</p> <p>Circumstances, especially parental education, matter a lot in explaining regional and country-specific distribution of opportunities.</p> <p>Only a small proportion of HOI improvement over time is due to fairer access of services. Most of the improvement comes from changes in the distribution of circumstances (partially associated to migration).</p>

Source: Authors.

Appendix 2: HOI, Op-BIA and Ex-ante Simulation of Fiscal Policies on Education

Exercise	Objective	Methodology	Assumptions	Data and other empirical issues for Liberia
School attendance HOI	Measure the equality of the opportunity for school attendance among children 6-15 in Liberia.	<p>HOI= C – P</p> $P = \sum_{k=1}^v (M_k - \bar{M}_k)$	The HOI is a good proxy for an equity-sensitive coverage rate. Circumstances used are relevant key drivers of inequity. A direct property of the HOI is that missing a relevant circumstance does not overwhelm the use of other circumstances: the estimated HOI is an upper bound of the true HOI.	<p>Core Welfare Indicators Survey 2007 and 2010</p> <p>Decomposition of key drivers for 2010 results and between 2007 and 2010 are performed.</p>
Opp-BIA	Assess the distribution of public resources among the distribution of opportunities and compare that allocation of resources with the distribution of those resources along wealth.	<p>$\phi(S,w)$ vs. $\phi(S,Opp)$</p> <p>where $\phi(\cdot)$ is the distribution of public spending S (net of private contributions), across quintiles of wealth, w, and opportunities, Opp.</p>	There is no relevant heterogeneity of public spending across groups; we can rely on a constant national unitary benefit.	Fiscal data from public education spending disaggregates level of education but not region, so the unitary benefit is a national average and not region-specific.
Ex-ante simulations	Attribute changes in estimated HOI due to changes in public spending on education.	<p>Step 1: Computing opportunities with spending</p> <p>[2] Estimate a new logit for school attendance including now as circumstance gross unitary benefit associated to attending school.</p> $\ln \left[\frac{P(T_i=1)}{1-P(T_i=1)} \right] = \alpha + \sum_j (\beta_j X_j)_i + \delta S_i + u_i$ <p>[3] Obtain the predicted probabilities of the logit for each group of circumstances:</p> $\hat{P}(T_i=1)$ <p>[4] Estimate the HOI (as indicated above) prior to the shock</p> $\hat{P}(T_i=1)$	<p>Step 1: Selected controls are the critical circumstances determining school attendance in Liberia.</p> <p>Step 2: Public spending is a valid circumstance, exogenous to the child.</p> <p>Step 3: The same coefficients of step 1 can be used to predict step 2: no change in reduced form</p>	<p>No additional data requirements.</p> <p>No change in sectoral policies considered following the redistribution of resources (a pure income or demand effect from a new monetized subsidy).</p>

		<p>HOI_{pre}</p> <p>Step 2: Policy Shock</p> <p>[5] Recalculate the probability for each group of children after the amount of benefits and/or identity of beneficiaries is changed according to each simulated scenario:</p> <ul style="list-style-type: none"> (i) Increase in spending for all eligible children (ii) Increase in spending towards fee expenses (iii) Increase in spending towards non-fee expenses (iv) Increase in spending targeted to rural children who do not attend school $\ln \left[\frac{P(T_i = 1)}{1 - P(T_i = 1)} \right]^{sim} = \hat{\alpha} + \sum_{ij} (\hat{\beta}_j X_j)_i + \hat{\delta} S_i^{sim}$ <p>[5] Estimate the probabilities after the shock and the new post-shock HOI:</p> $P(T_i = 1)^{sim}$ <p>Where sim= i... iv</p> <p>and:</p> $\hat{\alpha}$ <p>HOI_{sim}</p> <p>Step 3: Attribution</p>	<p>relationships. No behavioral changes assumed. The extra spending will be used towards education.</p> <p>Step 4: No interaction between spending and other circumstances. Other circumstances remain constant as we change the unitary benefit (a form of ceteris paribus comparison).</p>	
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		<p>[6] The differences in the prior and post-shock probabilities to attend school and HOI are attributed to the policy shock</p> $P(\hat{T}_i = 1)^{s \ i \ m} - P(\hat{T}_i = 1)$ $\hat{HOI}_{sim} - HOI$		
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Source: Authors.

Appendix 3: Logit Estimates for Public School Attendance Children Age 6-15

Independent Variables	Coef.	Std. Err.
Gender (male=1)	0.12	0.08
Location (urban=1)	-0.68	0.11**
Household head gender (female =1)	-0.35	0.11**
Children age	0.09	0.02**
Years of education of household head	0.05	0.01**
Age of household head	0.01	0.00
Number of children in household (15 or under)	0.04	0.02
Presence of elder (64+) in household (yes=1)	-0.01	0.14
Parents not in the household (if one or both not present =1)	-0.41	0.11**
Orphan (one or both parents deceased, =1)	-0.76	0.14**
Wealth quintile 2	0.04	0.12
Wealth quintile 3	0.30	0.13*
Wealth quintile 4	0.21	0.13
Wealth quintile 5	0.50	0.15**
North Western Region	-0.37	0.15**
North Central Region	0.71	0.20**
South Central	-0.63	0.14**
South Eastern (River Cess,Grand Gedeh, Sinoe)	-0.04	0.15
South Eastern (River G, Maryland, Grand Kru)	0.45	0.16**
Gross public transfers received	0.06	0.01**
Constant	-0.99	0.28**
n: 5,562		R ² = 0.19

(*) $p < 0.05$ (**) $p < 0.01$

Table 1: Educational Opportunities in Liberia: Incidence of Educational Opportunities among Liberian Children (%)

OPPORTUNITIES	CWIQ 2007	CWIQ 2010
Attending school (6-11years)	60.8	60.1
Attending school (12-15years)	66.7	73.8
Finish 6th grade (13-15)	17.7	11.7
Started primary on time (6-7)	16.1	10.2

Source: Authors' estimates from LISGIS (2007, 2008, 2010). Note: The respective values of these indicators for the DHS 2007 are 32 percent, 75 percent, 13 percent and 5 percent.

Table 2: Relevant Circumstances for Educational Opportunities in Liberia, 2007-2010 (percent of individuals with those circumstances)

CIRCUMSTANCES FOR CHILDREN UNDER 16 YRS	DHS 2007	CWIQ 2007	CWIQ 2010
Urban	36.0	28.9	-
Gender of the child	50.9	51.1	51.6
Gender of the head	68.8	74.7	77.8
Age of the head	43.9	43.1	43.7
Education of the head	5.3	5.6	5.5
Single parent	28.7	28.3	20.9
Number of children	3.9	3.6	3.768
Region	6	6	-
Mother alive	97.4	97.2	97.5
Father alive	95.0	93.2	95.2

Source: Authors' estimates from LISGIS (2007, 2008, 2010)

Table 3: The Distribution of Educational Opportunities in Liberia 2007

Type ID	Description	Estimated Probability of Access (%)
1	Rural, female child, head with no primary	53.8
2	Rural, male child, head with no primary	55.4
3	Urban, female child, head with no primary	54.8
4	Urban, male child, head with no primary	55.4
5	Rural, female child, head with primary	67.5
6	Rural, male child, head with primary	67.5
7	Urban, female child, head with primary	74.8
8	Urban, male child, head with primary	72.9

Source: Authors' estimates from LISGIS (2008)

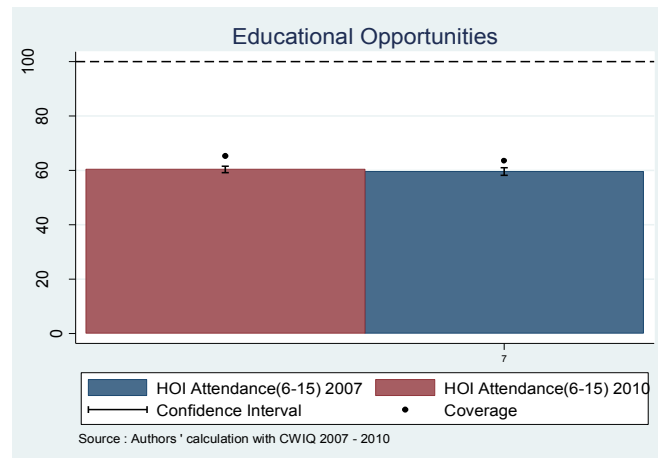
Table 4: Simulation Results

	Baseline (pre-shock)	Sim 1	Sim 2	Sim 3	Sim 4
Probability of attending school (%)	63.0	65.0	65.0	67.0	63.5
Estimated HOI(as%)	57	61	59.6	61.4	56.5
Unitary cost (US\$)	\$11.4 ^a	\$8 ^b	\$5.5 ^b	\$10.5 ^b	Urban: - \$11.4 ^b Rural: \$ 3.0 ^b
increase in public education spending (%) ^c	n.a.	70.0	48.0	92.1	0.0
<i>Group probability of attending school (%):</i>					
Urban children	69.0	70.0	70.0	70.0	67.2
Rural children	60.0	63.0	63.0	65.0	61.7
Type 1	53.9	55.9	56.6	58.9	55.4
Type 2	55.4	57.7	58.3	60.6	57.0
Type 3	54.8	55.6	56.0	57.1	53.6
Type 4	55.4	56.7	56.9	58.1	53.9
Type 5	67.5	70.2	70.1	72.1	68.9
Type 6	67.5	70.2	70.3	72.6	69.1
Type 7	74.9	75.9	75.7	76.4	73.9
Type 8	73.0	75.1	74.0	74.8	71.3

Source: Authors' estimates from LISGIS (2008)

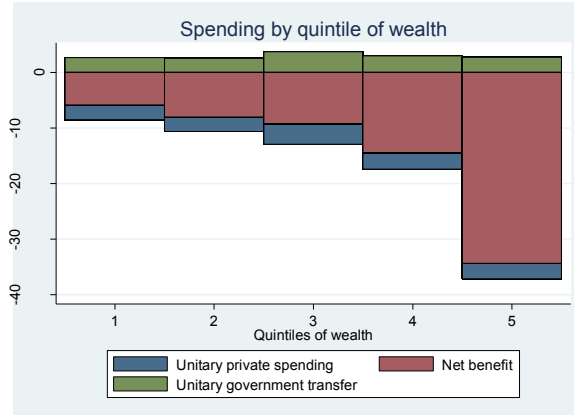
Notes: ^a Per beneficiary unitary gross spending on education. ^b Additional per beneficiary spending on education. ^c % increase over total public spending on education, that is, over US\$12.2 million.

Figure 1: HOI 2007 and 2010 in Liberia



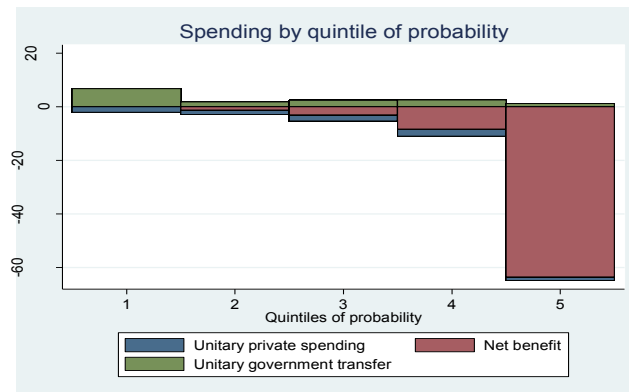
Source: Authors' estimates from LISGIS (2008, 2010)

Figure 2a BIA of Education Spending



Quintiles of wealth: Q1: (-1.80 to -0.60); Q2: (-0.60 -0.06); Q3: (-0.06 to 0.38); Q4: (0.38 to 1.09); Q5: (1.10 to 9.78).

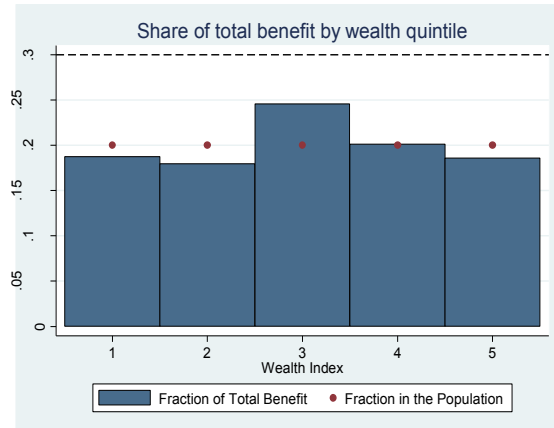
Figure 2b: Opp-BIA of Education Spending



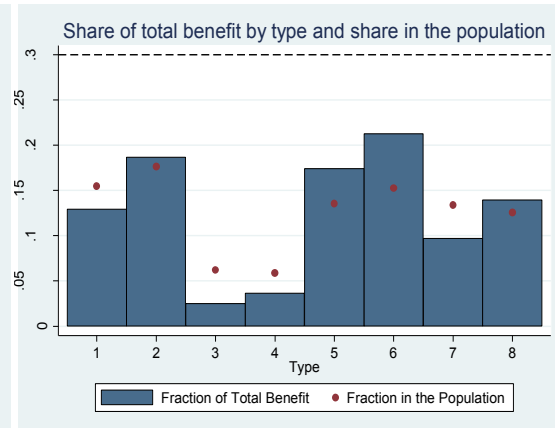
Quintiles of opportunities (proxied by quintiles of school attendance probability): Q1: (0 to 0.45); Q2: (0.45 to 0.52); Q3: (0.52 to 0.71); Q4: (0.71 to 0.85); Q5: (0.85 to 1)

Source: Authors' estimates from LISGIS (2008)

**Figure 3a: Share of Benefits
by Wealth Group**



**Figure 3b: Share of Benefits
by Circumstance Group**



Source: Authors' estimates from LISGIS (2008)

Notes: Types in Figure 3b are defined as reported in Table 3.